Egg Car Design Project

<http://vehiclesafety.wikispaces.com/Assignment>

**Introduction**:

Each year, thousands of people are killed and injured as a result of automobile accidents. Because of this, automotive safety design has become a major part of the auto industry. Safety engineers have concluded that passenger restraints are one safety device that could reduce automobile fatalities dramatically. Seat belts and shoulder harnesses keep passengers from being thrown from the vehicle or bounce around the vehicle’s interior causing injury.

Another category of safety devices is energy absorbing devices. They absorb or cushion the impact of collision. Some examples of an energy absorbing systems are airbags, bumpers and crumple zones.

With the combination of a restraint system and absorbing devises designed into a vehicle can help to save many lives. This activity will allow you to assume the role of a safety engineer as you design, install, and test safety devices for a crash vehicle.

**Task**:

As a mechanical engineer employed for a major automobile manufacture you have been assigned the task of designing and installing safety devices for a new test vehicle. The vehicle must be able to roll down a test ramp and into an immovable object at the end of the track (e.g., the wall) while protecting the passenger (a raw egg) from injury.

**Due Date**: All parts of this project (i.e., the car, the lab write up, and the flash page with signature) must be completed before December 19th. You may want to complete the project early in case of a last minute emergency on the 19th. No projects will be allowed past this date.

**Problem**: Develop a question that you can test to make sure the egg is safe in the car. Remember to use the correct format…How does (IV) affect (DV).

**Materials**:

In creating your vehicle try to use recycled materials (e.g., cardboard tubes, tissue boxes, etc) Be creative in your design!

Examples of assorted materials for constructing safety devices.

* Bubble wrap, rubber bands, weather-stripping, cotton balls, Styrofoam, wood/plastic egg (dummy)

This is only a list of suggestions; if you think of other materials that may be helpful you are welcome to use them.

-**You will be responsible for bringing in your own raw egg.**

**Procedure**: Develop a written procedure to test your problem.

**Vehicle Design**: Design Constraints

1. The car must fit on the ramp within the starting gate.

The dimensions of the ramp are 24 cm wide and 66 cm long.

There is a 6 cm gap between the ramp and the bottom of the start gate.

The start gate is   
2. The egg must be raw and able to be moved in and out of the vehicle easily.

3. No part of the egg may be glued to any part of the car or the safety device.

4. The front of the car is defined as the end of the car that the driver is facing. The car may not travel

down the ramp backwards.

5. No part of the safety device can extend beyond the base of the car (width or length)

6. Car must be able to **ROLL** down the ramp. All wheels must be in contact with the ramp and must roll.

(Car may not slide down the ramp.)

7. No part of a toy car may be used. Wheels and all other components must be created by the designer.

Cars with prefabricated wheels or chassis will not be accepted for credit.

8. **All parts of the vehicle must be labeled with metric measurements on the lab report.**

9. **The dimensions of the vehicle must be labeled on the lab report using metric measurements**.

10. You may bring your car in for a test during the first 10 minutes of lunch or after school. You may not

test during homeroom.

**Testing: Protection of the Egg**

It is highly recommended that you test your design before the due date. Points will be awarded based on the condition of the egg after the ‘crash’.

**Appearance**:

Use recycled materials if possible. Be creative with your design and the appearance. Neatness Counts! The car must be neat and colorful.

**Presentation: Written and Oral**

Your vehicle will be tested and presented to the class. There should be a lab write up that includes a labeled diagram.

|  |  |  |
| --- | --- | --- |
| Egg Car Design | Possible Points | Score |
| Safety Features Present and Functional | 20 |  |
| Functionality of the Car | 10 |  |
| Protection of the Egg | 15 |  |
| Appearance of the Car | 5 |  |
| Total Design Score (Summative Assessment) | 50 |  |
| Presentation Written and Oral |  |  |
| Lab Write Up | 40 |  |
| Oral Presentation | 10 |  |
| Total Presentation Score (Summative Assessment) | 50 |  |

Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Period: \_\_\_\_\_\_\_\_\_\_\_\_\_\_

Egg Car Safety Testing

**Problem**: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Independent Variable**:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Dependent Variable**: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Controlled Variables**:

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Hypothesis**:

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**Materials for both vehicle and restraint system**.

**Testing Procedure**:

1.

2.

3.

4.

**Vehicle Design** – Don’t forget the measurements

Top View Side View

**Data**: Calculation worksheet:

1. Total mass of your car? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_g \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_kg

2. What was your time? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_sec.

3. To show average speed, use the formula speed = distance/time

Distance: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

4. To show Net Force use the formula – Force = mass x acceleration.

**Claims**: Answer your Problem

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Evidence**: Support your claim with evidence (data) from your experiment.

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**Comparisons**: How does your claim compare to what is already known?

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**Reflection**: Write about how the concepts taught in class have applied to this project. You must correctly include all of the following terms. Position, Speed, acceleration, mass, friction, Energy-Kinetic and Potential, All 3 of Newton’s Laws of Motion, inertia, and gravity. Be very specific and give examples!! .

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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| --- | --- | --- | --- |
| **Design** | **Excellent**  **9 - 10** | **Satisfactory**  **7 - 8** | **Needs Improvement**  **6 - 0** |
| Safety Features (X2) | Allow for the egg to be moved into and out of the vehicle. Both restraint and energy absorption materials are included and are appropriate for protecting the egg. | Allow for the egg to be moved into and out of the vehicle. Either restraint and energy absorption materials are included | Egg cannot be moved into and out of the vehicle. Minimal/no energy absorption material used. No restraint system |
| Functionality of the Car | All Design Constraints have been met.  Car rolls down the ramp and stays intact upon impact. | Most of the Design constraints have been met  Car rolls down the ramp and only loses a few parts on impact | Few if any of the Design constraints have been met.  Car doesn’t roll down ramp or mostly fall apart on impact. |
| Appearance  (X .5) | Decorations are neat, colorful and the vehicle is made to look like a car. | Decorated but the decorations interfere with the function or doesn’t look like a car. | Not decorated at all. Doesn’t not look anything like a car |
| Protection of the Egg  (X1.5) | The egg is undamaged and still in position | The egg is only slightly damaged and is only slightly out of position | The egg is significantly damaged and is completely out of position. |
| **Written/Oral**  **Presentation** | **Excellent**  **9 - 10** | **Satisfactory**  **7 - 8** | **Needs Improvement**  **6 - 0** |
| Lab Write up | Completed all parts accurately and thoroughly | Completed all parts accurately or most parts accurately and thoroughly | Completed only some of the parts accurately or not at all. |
| Explanation of how Physics concepts apply (X2) | Included an explanation of how all physics concepts were demonstrated in this project. Examples are given and are accurate. | Included an explanation of how most of the physics concepts were demonstrated in this project. Examples were given but not accurate or weren’t given at all | Included an explanation on just one or two physics concepts. Examples weren’t given or weren’t accurate. |
| Vocabulary | Scientific vocabulary is used correctly and in all appropriate places. | Science vocabulary is used. May not be complete accurate or in all appropriate places. | Science vocabulary is used minimally, not correctly, or not at all. |
| Oral Presentation | Speaks clearly. Explains experiment concisely but thoroughly. Makes eye contact with audience. DOES NOT READ OFF PAPER. | Speaks clearly. Explains experiment Makes some eye contact with audience. Read from paper occasionally. | Explains experiment Makes little or no eye contact with audience. Read mostly from paper. |

Egg Car Project Egg Car Project

Safety Features (X2) \_\_\_/20 Safety Features (X2) \_\_\_/20

Functionality of the Car \_\_\_/10 Functionality of the Car \_\_\_/10

Appearance \_\_\_/5 Appearance \_\_\_/5

Protection of the Egg \_\_\_/15 Protection of the Egg \_\_\_/15

Design Total \_\_\_/50 Design Total \_\_\_/50

Lab Write Up \_\_\_/10 Lab Write Up \_\_\_/10

Explanation of Physics \_\_\_/20 Explanation of Physics \_\_\_/20

Vocabulary \_\_\_/10 Vocabulary \_\_\_/10

Oral Presentation \_\_\_/10 Oral Presentation \_\_\_/10

Presentation total \_\_\_/50 Presentation total \_\_\_/50

Egg Car Project Egg Car Project

Safety Features (X2) \_\_\_/20 Safety Features (X2) \_\_\_/20

Functionality of the Car \_\_\_/10 Functionality of the Car \_\_\_/10

Appearance \_\_\_/5 Appearance \_\_\_/5

Protection of the Egg \_\_\_/15 Protection of the Egg \_\_\_/15

Design Total \_\_\_/50 Design Total \_\_\_/50

Lab Write Up \_\_\_/10 Lab Write Up \_\_\_/10

Explanation of Physics \_\_\_/20 Explanation of Physics \_\_\_/20

Vocabulary \_\_\_/10 Vocabulary \_\_\_/10

Oral Presentation \_\_\_/10 Oral Presentation \_\_\_/10

Presentation total \_\_\_/50 Presentation total \_\_\_/50